REMARKS

Claims 1-4 and 6 are pending in the current application. Claim 5 has been canceled without prejudice.

Claims 1 and 3 have been amended and claim 5 has been canceled without prejudice. Support for the amendment of claim 1 can be found at least in the first full paragraph on page 15 of the Specification. Claim 3 has been amended to incorporate the subject matter of canceled claim 5. Accordingly, no new matter has been added by way of this Amendment and entry thereof is respectfully requested.

Objections to the Specification

The Examiner objects to the Specification for various informalities including the use of the reference numeral 11 for both an "electrolyte membrane" and a "catalyst layer" on page 22, line 18, and the use of the reference numeral 45 to indicate both "gas flow channels" and "separator plates" on page 33, lines 4 and 8. The Examiner also notes that the Abstract contained two paragraphs.

The Specification has been amended to correct the reference numerals. Additionally, the Abstract of the Disclosure has been amended. A clean copy of the Abstract is attached. Accordingly, it is respectfully requested that the objections be reconsidered and withdrawn.

Rejection of Claims 1-6 under 35 U.S.C. § 102 (b)

The Examiner rejects claims 1-6 under 35 U.S.C. § 102 (b) as being anticipated by U.S. Patent No. 5,738,905 to Bevers ("Bevers"). The Examiner argues that Bevers discloses a fuel cell with a membrane electrode assembly, which comprises a proton-conductive membrane (34), a pair of catalyst layers (50) and a pair of gas diffusion layers (52). The Examiner notes that the catalyst in Bevers may be applied as several sub-layers (50, 50a, 50b) using copier drums, where the polymers undergo a greater degree of melting toward the membrane and less melting toward the gas-diffusion layers. The Examiner suggests that since the sub-layers are made of the same powder, this would mean that their density is greater near the membrane, while the relative portions of their constituents stay the same through the catalyst layer.

Applicants respectfully traverse the rejection and the arguments in support thereof. Applicants respectfully submit that Bevers does not disclose explicitly or inherently that the density of the layers (50, 50a, 50b) decrease from the proton conductive electrolyte membrane to the gas diffusion layer.

In order for a rejection under § 102 (b) to be proper, a single reference must disclose, either explicitly or inherently, each and every element of the claimed invention. Inherency requires that the missing descriptive matter be necessarily present in the thing described in the reference. *In re Robertson*, 169 F.3d 743, 745, 49 USPQ2d 1949, 1950-51 (Fed. Cir. 1999). The fact that a certain result may or may not occur in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijckaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955, 1957 (Fed. Cir. 1993). *See also* MPEP 2112 IV.

The present invention is directed to an electrolyte membrane-electrode assembly for a fuel cell which comprises a proton conductive electrolyte membrane; a pair of catalyst layers; and a pair of gas diffusion layers. Each of the catalyst layers comprise a polymer electrolyte and a catalyst carried by an electrically conductive catalyst carrier. Also, the catalyst layers comprise a plurality of catalyst thin film layers, where the catalyst layers have a density that decreases from positive electrolyte membrane to the gas diffusion layer. Additionally, the weight ratio is substantially constant through the catalyst layers.

Bevers, on the other hand, does not disclose, either explicitly or inherently, that the density of the layers decreases from the proton conductive electrolyte membrane (21) to the gas diffusion layer (20). Applicants acknowledge that the solid-electrolyte material in Bevers melts in varying degrees in each of the catalytic layers (50, 50a, 50b).

However, Figure 8 in Bevers does not show or disclose that the layers are compressed as the other layers are pressed onto the existing layers. Although Bevers states that the degree of melting is decreased as each layer is applied, it mentions nothing about compression or a change in density.

The Examiner's argument that since the sublayers are made of the same powder and the degree of melting increases toward the proton conductive electrolyte membrane, the density would therefore be impacted is inaccurate. As shown in Fig. 8, the layers have the same thickness, even with the varying degrees of melting. Since the same amount of space is taken up by the same amount of material, the density would remain the same.

Also, nothing is mentioned in Bevers regarding a change in layer thickness. Just because there is a varying degree of melting throughout the layers does not mean that the density would inherently change. Typically when objects change from a solid phase to a liquid phase, they tend to occupy a greater space (the exception being water) and therefore have a lower density. Which in this case would cause the density to increase from the proton conductive electrolyte membrane 34 to the gas diffusion layer – at least temporarily as the solid electrolyte particles melt and then resolidify.

There is no disclosure in Bevers' text about the thickness of the layers changing due to the melting. Nor is there any indication in Fig. 8 that the thickness of the layers changes. The arrangement of the solid electrolyte particles within the layers shown as being altered as the layers are closer to the proton conductive electrolyte membrane 34 does not necessarily indicate a change in density as claimed. Therefore, the density of the layers (50, 50a, 50b) is not necessarily decreasing from the proton conductive electrolyte membrane 34 to the gas diffusion layer.

Since there is no discussion or suggestion that the thickness of the layers of Bevers decreases as the layers approach the proton conductive electrolyte membrane, and since each layer presumably has the same mass, it can be argued that the density remains the same.

As argued above, the description in Bevers is left open for interpretation. The argument that the density may decrease from the proton conductive electrolyte membrane 34 to the gas diffusion layer, is not sufficient for inherency. Therefore the Examiner has not supplied the requisite basis in fact or technical reasoning and accordingly has not met his burden for establishing inherency.

Claim 3 of the present invention discloses a method of making an electrolyte membrane-electrode assembly for a fuel cell. The method includes a pressing force towards the proton conductive electrolyte membrane. This compacts the plurality of catalyst thin film layers toward the proton conductive electrolyte membrane – thus causing the density of the layers to decrease from the proton conductive electrolyte membrane to the respective gas diffusion layers.

As discussed above, Bevers does not explicitly or inherently disclose that the density of the layers decreases from the proton conductive electrolyte membrane to the respective gas diffusion layers.

Bevers does include a pressing force which would be applied by a roller or rollers (Col. 5, line 54; Col. 6, lines 19, 52-55). However, using a roller or rollers for pressing any harder than what it would take to apply a layer would tend to spread the catalyst outward and beyond the perimeter of the proton conductive electrolyte membrane. Therefore, one skilled in the art would question whether the pressing in Bevers is used to compact the layers or if it is merely just for application of each of the subsequent layers.

As argued above, the description in Bevers is left open for interpretation. Just because a pressing force is applied does not mean that it is used for causing a compaction of the layers so that the density of the layers decreases from the proton conductive electrolyte membrane to the respective gas diffusion layers. Therefore the Examiner has not supplied the requisite basis in fact or technical reasoning and accordingly has not met his burden for establishing inherency.

In conclusion, since the Bevers does not explicitly or inherently disclose that the density of the layers decreases from the proton conductive electrolyte membrane to the respective gas diffusion layers, claims 1-6 are not anticipated by Bevers. Accordingly, it is respectfully requested that the rejection be reconsidered and withdrawn.

Rejection of Claims 3-6 under 35 U.S.C. § 103 (a)

The Examiner rejects claims 3-6 under 35 U.S.C. § 103 (a) as being unpatentable over Bevers in view of U.S. Patent No. 6,524,736 to Sompalli ("Sompalli"). The Examiner argues that Sompalli discloses a process for forming catalyst layers on a substrate or decal applying the layer to a polymer electrolyte membrane and removing the decal. The decal allegedly disclosed by Sompalli provides "good transfer of the catalyst onto the membrane" and allows for the vaporization of any residual solvent left in the electrode membrane. The Examiner argues that the catalyst of Bevers may be applied in a wet chemical process which would raise the possibility of residual water in his catalyst layer and therefore it would be obvious to use the decal of Sompalli to form and apply the catalyst layers of Bevers.

Applicants respectfully traverse the rejection and arguments in support thereof. Applicants respectfully submit that claims 3-6 are not obvious over Bevers in view of Sompalli since Bevers and Sompalli fail to teach or suggest that the density of the layers decreases from the proton conductive electrolyte membrane to the respective gas diffusion layers. Also, there is

no motivation to combine the two references, and even if there was such motivation to combine, there would be no reasonable expectation of success.

To establish a prima facie case of obviousness the prior art references must teach or suggest all of the claim limitations, there must be a motivation to combine the references, and there must be a reasonable expectation of success.

The present invention includes a method of making an electrolyte membrane-electrode assembly for a fuel cell. The steps include using a transfer sheet to form a thin film catalyst layer on a proton conductive electrolyte membrane and repeating the step at least once. The layers each have a substantially constant weight ratio and as each layer is applied a pressing step occurs which compresses each layer and causes there to be a decrease in density through each of the layers from the positive electrolyte membrane to the gas diffusion layer.

As discussed above, Bevers does not disclose or suggest a pressing step which would create a decrease in density in each the catalyst layers from the positive electrolyte membrane to the gas diffusion layer. Sompalli does not cure the deficiency of Bevers in this respect. Sompalli does not disclose a pressing step which compresses each layer and causes a decrease in density through each of the layers from the positive electrolyte membrane to the gas diffusion layer. Nor can applicants even find where Sompalli discloses more than one catalyst layer.

Additionally, there is no motivation to combine the references. Bevers is directed to multiple layers and Sompalli only discloses one layer. Furthermore, Bevers uses a roller for application and Sompalli uses decals. Neither reference suggests a change or alteration that would lead a person of ordinary skill in the art to augment the reference in such a way that would suggest that the two references even be combined.

Even if there was some minimal amount of motivation to combine and modify the references, there would be little expectation of success in reaching the present invention since some of the claim elements are not disclosed in either reference. If the two references were combined, one of ordinary skill in the art would be left with no teaching or suggestion of an electrolyte membrane-electrode assembly with catalyst thin film layers that have a decreasing density from the proton conductive electrolyte membrane to the respective gas diffusion layers. Accordingly, a reasonable expectation of success is not provided by the combination of references.

Since a prima facie case of obviousness has not been met, the rejection over Bevers in view of Sompalli is improper. Accordingly, it is respectfully requested that the rejection be reconsidered and withdrawn.

In view of the amendments made herein and the remarks set forth above, it is respectfully submitted that the Specification is unobjectionable and that the claims are allowable over the prior art of record. Therefore, a Notice of Allowance is respectfully requested.

Respectfully submitted,

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